

REMARKS

Further and favorable reconsideration is respectfully requested in view of the foregoing amendments and following remarks.

Claim 1 has been amended to recite that the graft polymer side chain has a reactive functional group, wherein the reactive functional group is converted from an anion exchange group introduced onto the graft polymer chain. Claims 6 and 18-20 have been amended to more clearly set forth the method steps. Support for these amendments can be found on page 7, line 37 to page 8, line 3 of Applicants' specification. Therefore, no new matter has been added to the application.

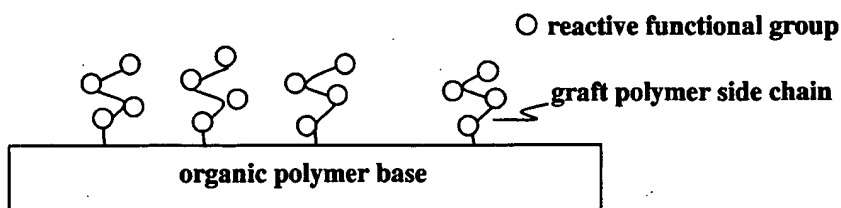
The rejection of claims 1-4, 6, 12-14 and 18-21 as being indefinite under 35 U.S.C. § 112, second paragraph is respectfully traversed.

The Examiner asserts that claim 1 discloses a reactive functional group such that the group is introduced onto the polymer side chain. The Examiner takes the position that the term "a grafted monomer" is not clear, i.e., is the group an additional group introduced onto the polymer side chain?

The Examiner further asserts that claims 6 and 18-20 disclose a process for making a solid reagent. The Examiner takes the position that there is no step for how to make the solid reagent. The Examiner further states that the term "capable" renders the claim indefinite.

Applicants have amended the claims to delete the "capable of" language. Additionally, Applicants have amended the claims to more clearly set forth the invention.

The solid reagent of Applicants' invention has the following structure:



As recited in Applicants' amended claim 1, the solid reagent comprises an organic polymer base in which a graft polymer side chain is introduced onto the backbone of the organic polymer base, wherein the graft polymer side chain has a reactive functional

group selected from those recited in the claim, and wherein the reactive functional group is converted from an anion exchange group introduced onto the graft polymer side chain. Further, as recited in Applicants' claim 2, the organic polymer base can be in the form of a fiber, a woven or non-woven fabric consisting of an assembly of fibers, a porous membrane or a hollow fiber membrane, as recited in Applicants' claim 2.

As recited in Applicants' amended claims 6 and 18-20, the solid reagent is prepared by graft-polymerizing a polymerizable monomer onto the backbone of an organic polymer base to form a graft polymer side chain, introducing an anion exchange group onto the graft polymer side chain to form a graft polymer side chain having the anion exchange group, and converting the anion exchange group on the graft polymer side chain into a reactive functional group selected from those recited in the claims. Further, as recited in Applicants' claim 12, the graft polymer side chain can be introduced by radiation-induced graft polymerization. In other words, in one embodiment of Applicants' invention, the organic polymer base is irradiated by radiation to produce radicals on the organic polymer base, which are then reacted with a graft monomer to undergo graft polymerization, and introduce graft polymer side chains onto the organic polymer base. (See page 5, lines 23-25 of Applicants' specification.)

The following is a description of a non-limiting example of Applicants' claimed process. (See page 7, line 29 to page 8, line 22 of Applicants' specification.)

Chloromethylstyrene is graft-polymerized onto the uncrosslinked organic polymer base to form a chloromethylstyrene grafted polymer base. Chloromethylstyrene is reacted with trimethylamine to introduce a quaternary ammonium-type anion exchange group onto the graft polymer side chain. The quaternary ammonium-type anion exchange group is converted to a reactive functional group such as hypochlorite ion, periodate ion, peroxide ion, chromate ion, dichromate ion, perruthenate ion, tetrahydroborate ion, cyanotrihydroboroate ion, tribromide ion, cyanide ion, thiocyanate ion, azide ion or nitrite ion.

The following is another description of a non-limiting example of Applicants' claimed process. (See page 8, line 23 to page 9, line 5 of Applicants' specification.)

4-vinylpyridine is graft-polymerized onto the uncrosslinked organic polymer base to form a 4-vinylpyridine grafted polymer base. 4-vinylpyridine is reacted with alkyl

halide to introduce a quaternary pyridinium-type anion exchange group onto the graft polymer side chain. The quaternary pyridinium-type anion exchange group is converted to a reactive functional group such as hypochlorite ion, periodate ion, peroxide ion, chromate ion, dichromate ion, tribromide ion, or the like.

Applicants' invention is characterized in that the graft polymer side chain has the reactive functional groups which are converted from the anion exchange groups which are introduced onto the graft polymer side chain. Specifically, the reactive functional groups are introduced onto the graft polymer side chain by conversion of the anion exchange groups on the graft polymer side chain into the reactive functional groups.

Applicants' solid reagent has the advantageous effects of permitting easy access of a starting compound to any site of the graft polymer side chain at which the reactive functional group has been introduced, increasing a diffusion speed of a starting compound, permitting easy recovery of the product after the reaction, increasing the process efficiency due to higher flow rate, and keeping the physical strength of the polymer backbone of the organic polymer base. See page 10, lines 15-35 of Applicants' specification.

In light of the above discussion, it is clear that the reactive functional group is introduced onto the graft polymer side chain by conversion of the anion exchange groups on the graft polymer side chain into the reactive functional groups.

Furthermore, Applicants' have deleted the "capable of" language, and have more clearly set forth the steps for making the solid reagent.

Therefore, Applicants respectfully request that the rejection based on 35 U.S.C. § 112, second paragraph be withdrawn.

The patentability of the present invention over the disclosures of the references relied upon by the Examiner in rejecting the claims will be apparent upon consideration of the following remarks.

Thus, the rejection of claims 1-4, 6, 12-14 and 18-21 under 35 U.S.C. § 102(b) as being anticipated by Garnett et al. (US '736) or JP '754 or Frey et al. (US '654) or Sugo et al. (US '400) is respectfully traversed.

As discussed above, Applicants have amended the claims to more clearly set forth that an anion exchange group is introduced onto the graft polymer side chain, and the

anion exchange group is converted into the reactive functional group. None of the cited references teach or suggest this limitation.

Garnett et al. describe a backbone polymer grafted with a vinyl pyridine monomer via radiation to induce a graft polymerization process. The Examiner takes the position that the vinyl pyridine can include various moieties, and that the polyvinylpyridine having functional group reads on Applicants' recited polymer side chain having a reactive functional group

However, Garnett et al. fail to teach or suggest a process of introducing an anion exchange group onto the graft polymer side chain, as required in Applicants' amended claims 6, 18, 19 and 20. Furthermore, Garnett et al. fail to teach or suggest a solid reagent comprising an organic polymer base in which a graft polymer side chain is introduced onto the backbone of the polymer base, wherein the graft polymer side chain has a reactive functional group selected from those recited in claim 1, and wherein the reactive functional group is converted from an anion exchange resin introduced onto the graft polymer side chain, as required in Applicants' amended claim 1.

The Examiner takes the position that JP '574 discloses Applicants' claimed grafted polymer chain having a functional group. However, JP '574 fails to teach or suggest that the quaternary amine moiety on the graft-polymerization membrane is converted into the reactive functional groups, as required by Applicants' amended claims.

The Examiner takes the position that Frey et al. discloses polyolefin material grafted with polyvinylidene chloride. However, Frey et al. fail to teach or suggest that the grafted polyvinylidene chloride is converted into the reactive functional groups, as required by Applicants' amended claims.

The Examiner takes the position that Sugo et al. disclose a polymeric substrate grafted with a polymerizable hydrophilic monomer that can have styrenesulfonic acid moiety. However, Sugo et al. fail to teach or suggest that the sulfonic groups are converted into the reactive functional groups, as required by Applicants' amended claims.

Therefore, none of the above references teach or suggest the limitations of Applicants' amended claims.

For these reasons, the invention of claims 1-4, 6, 12-14 and 18-21 is clearly patentable over Garnett et al. (US '736) and JP '754 and Frey et al. (US '654) and Sugo et al. (US '400).

The rejection of claims 1-4, 6, 12-14 and 18-21 on the ground of non-statutory obviousness-type double patenting as being upatentable over claims 1-5 of US '432; as well as the rejection of claims 1-4, 6, 12-14 and 18-21 under 35 U.S.C. § 103(a) as being obvious over US '432, are respectfully traversed.

As discussed above, Applicants have amended the claims to more clearly set forth that an anion exchange group is introduced onto the graft polymer side chain, and the anion exchange group is converted into the reactive functional group. None of the cited references teach or suggest this limitation.

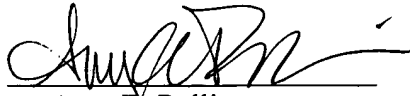
US '432 fails to teach or suggest the limitations of Applicants' amended claims. US '432 discloses that the polymerizable monomer side chain having the cation or anion exchange group is graft-polymerized onto the polyolefin base. However, US '432 fails to teach or suggest introducing the anion or cation exchange group onto the graft polymer side chain, as required in Applicants' amended claims. Additionally, US '432 fails to teach or suggest converting the anion or cation exchange group on the graft polymer side chain into the reactive functional groups, as required in Applicants' amended claims.

For these reasons, the invention of claims 1-4, 6, 12-14 and 18-21 is clearly patentable over US '432.

Therefore, in view of the foregoing amendments and remarks, it is submitted that each of the grounds of rejection set forth by the Examiner has been overcome, and that the application is in condition for allowance. Such allowance is solicited.

Respectfully submitted,

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